

SOUTHWESTERN ALASKA
RAINBOW TROUT INVESTIGATIONS,
GERTRUDE CREEK,
BECHAROF NATIONAL WILDLIFE REFUGE

PROGRESS REPORT 90-1

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ABSTRACT

Rainbow trout (Oncorhynchus mykiss), char (Salvelinus sp.), and Arctic grayling (Thymallus arcticus) were investigated during June and September, 1988 at Gertrude Creek, Becharof National Wildlife Refuge, Alaska, to collect information on the population structure, distribution, and sport fishing effort. The study was initiated because refuge personnel had noted an increase in angler pressure in Gertrude Creek and were particularly concerned that the rainbow trout population was being adversely impacted. Rainbow trout were captured by hook and line and sampled to determine age, length, and weight composition, and distribution. Char and Arctic grayling were sampled to determine length, weight, and distribution. Special Use Permit reports were used to estimate sport harvest.

Sampled rainbow trout fork lengths (FL) ranged from 310-588 mm. Gertrude Creek rainbow trout were primarily represented in the Preferred (400 - 499 mm FL) and Memorable (500 - 599 mm FL) Relative Stock Density (RSD) categories (79%). For comparison, 74% and 61% of the rainbow trout from the Kanektok and Goodnews Rivers on the Togiak National Wildlife Refuge were represented in the Preferred and Memorable RSD categories. Rainbow trout aged using otoliths ranged from 4-11 years. The age and length data suggest the rainbow trout population has not been excessively impacted by fishing. Rainbow trout and char were distributed in the lower 15 km of Gertrude Creek. Arctic grayling were located throughout Gertrude Creek, although primarily in the upper 10 km.

Special Use Permit report data only provide a measure of the guided sport fishing activity on the Becharof National Wildlife Refuge. No harvest information on unguided sportfishing were available. In addition, the data provided by the Special Use Permit was not specific enough to estimate the harvest within individual drainage. Modification and expansion of the Special Use Permit or a creel census program would be required to generate harvest estimates.

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INTRODUCTION

Population characteristics of rainbow trout (Oncorhynchus mykiss), char (Salvelinus sp.), and Arctic grayling (Thymallus arcticus) were investigated in Gertrude Creek on Becharof National Wildlife Refuge, Alaska. Gertrude Creek, a tributary to the King Salmon River, is a popular rainbow trout sport fishing area. Gertrude Creek's close proximity to the town of King Salmon (63 km) and accessibility by both wheel and float plane have contributed to it's popularity. The King Salmon River drainage is also important for local subsistence use (U.S. Fish and Wildlife Service 1985). Concerns for the fishery exist because: (1) there is limited information on fish populations and; (2) sport fishing effort is increasing which could be depressing the stock productivity (U.S. Fish and Wildlife Service 1987). This investigation will primarily describe the rainbow trout population. Because char and Arctic grayling are also caught by sport anglers, a brief description of these populations are also presented.

Little information has been obtained on Gertrude Creek rainbow trout. The Alaska Department of Fish and Game (Department) conducted two float trips to sample Gertrude Creek fish in 1970 and 1977 (R. Russell, Alaska Department of Fish and Game, personal communication). These rainbow trout are considered to be the most southernly occurring non-anadromous trout population on the Alaska Peninsula (Alaska Department of Fish and Game 1978). The Department, in cooperation with U.S. Fish and Wildlife Service (Service), sampled Gertrude Creek fish in 1983 (D. Mumma, U.S. Fish and Wildlife Service, personal communication) and the Service again sampled rainbow trout in 1987 (T. Wagner, U.S. Fish and Wildlife Service, personal communication). A combined total of 91 rainbow trout were collected and ranged in size from 272 mm to 577 mm fork length (FL). Thirty-two percent (29) of the rainbow trout were not aged because of regenerated scales, 57 percent (52 fish) were

successfully aged by scale, and 11 percent (10 fish) were aged by both scales and otoliths. Sampled fish ranged in age from 4-10 years, and the discrepancy between otolith and scale ages ranged from 1-3 years.

To compliment these previous studies, the King Salmon Fishery Assistance Office initiated a two-year investigation. Study objectives were to: (1) describe rainbow trout distribution, length, weight, condition, age structure, and sex composition; (2) describe length, weight and distribution of char and Arctic grayling; and (3) determine the feasibility of using Special Use Permit reports to determine catch, harvest and effort. Field sampling occurred in June and September, 1988. The emphasis for 1988 was to sample Gertrude Creek sport fish populations using hook and line techniques and determine the feasibility of using Refuge Special Use Permit reports to evaluate the sport fishing pressure.

STUDY AREA

Gertrude Creek originates in the Becharof National Wildlife Refuge Wilderness Area and flows 21 km before entering the King Salmon River (Figure 1). Gertrude Creek is clear, shallow, and averages 5 m in width. Several small tributaries feed into Gertrude Creek. At river kilometer (Rkm) 13 Gertrude Creek diverges into east and west forks.

The climate is moderate, polar maritime, characterized by high winds, mild temperatures, protracted cloud cover, and frequent precipitation. Most vegetation around Gertrude Creek is a low shrub/grass tundra community interspersed with zones of lichen/shrub tundra (U.S. Fish and Wildlife Service 1985).

A wide variety of anadromous and resident fish utilize the creek. Rainbow trout, char, Arctic grayling, chinook (Oncorhynchus tshawytscha), chum (O. keta), pink (O. gorbuscha), and sockeye salmon (O. nerka) spawn and, with the exception of chum and pink salmon, probably rear in Gertrude Creek

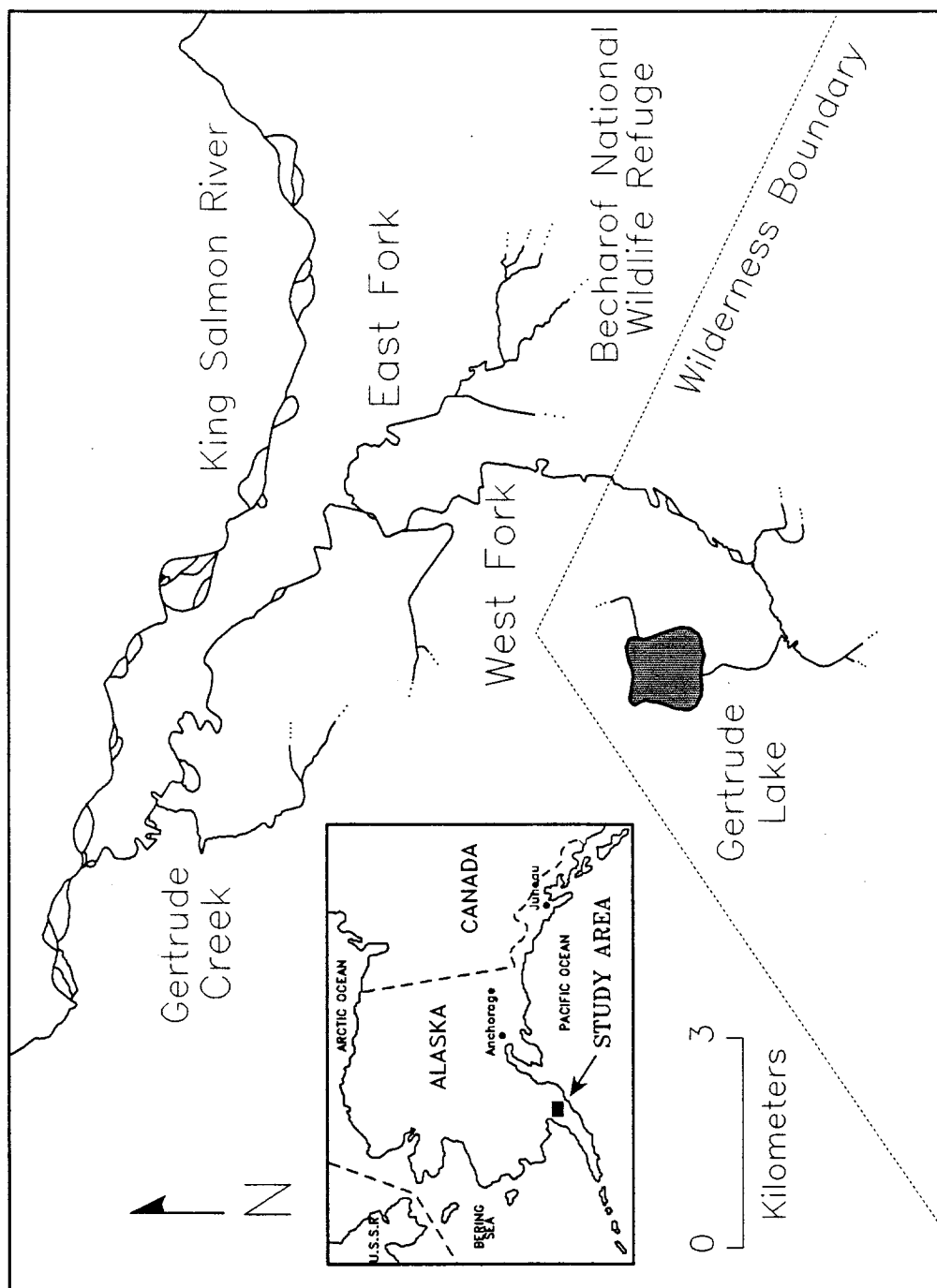


Figure 1.-Gertrude Creek and King Salmon River, Becharof National Wildlife Refuge, Alaska.

(R. Russell, Alaska Department of Fish and Game, personal communication).

METHODS

A float trip was conducted 27-30 June, 1988 to sample fish along the entire length of Gertrude Creek. Day trips by helicopter concentrated sampling effort below the east and west forks on 3 and 4 September 1988. Fish were captured by hook and line sampling.

Length and weight measurements were taken from all captured rainbow trout. Fork length (FL) measurements were recorded to the nearest mm and weight measurements were recorded to the nearest 0.025 kg. The coefficient of condition (K) (Carlander 1969) was calculated as,

$$K = W(10^5)/L^3$$

where:

W = weight (kg)

L = length (mm)

Regression was used to estimate the length-weight relationship (Ricker 1975). Relative Stock Density (RSD) (Wege and Anderson 1978) was estimated for rainbow trout based on fork length measurements. Length categories of Stock, Quality, Preferred, Memorable, and Trophy were adapted from Gablehouse (1984). The RSD length ranges used were: Stock <300 mm; Quality 300-399 mm; Preferred 400-499 mm; Memorable 500-599 mm; Trophy >600 mm. Size categories selected for RSD estimates were based on those selected by Wagner (1989 (in press)).

Scales were taken from the preferred scale area (Jearld 1983) on all rainbow trout. Scales were aged according to techniques described by Koo (1962). Scales were pressed on acetate sheets, magnified on a microfiche reader, aged by two readers, and a third reader was used to resolve disagreements. Regenerated scales were discarded.

Up to 10 rainbow trout per 25 mm length group were sacrificed for obtaining otoliths. Otoliths were stored in a 2:3 glycerine:alcohol solution (Jearld 1983). Otoliths to be analyzed were cleared with clove oil, ground on a coarse whetstone to enhance readability, and read according to Barber and McFarlane (1987). Otoliths were aged by two readers, and a third reader was used to resolve disagreements.

Sex was determined from a subsample of the fish sacrificed for otolith collection. Gonads were examined to determine sexual maturity.

Length and weight measurements were recorded from a subsample of Arctic grayling and char. Regression was used to estimate the length-weight relationship of Arctic grayling (Ricker 1975).

Refuge Special Use Permit reports from 1981 through 1988 were reviewed and summarized to determine if harvest and effort data for specific King Salmon River drainages could be determined.

RESULTS

All rainbow trout were captured from the confluences of the east and west forks downstream to about 1 km above the confluence with the King Salmon River. Arctic grayling were found primarily in the west fork and char were generally located in the same area as rainbow trout.

Eighty-six rainbow trout lengths ranged from 310-588 mm (Figure 2). The mean length at age ranged from 352 mm at age 4 to 560 mm at age 11 (Table 1). Twenty-one percent of the sampled rainbow trout were classified in the Quality category, 46 percent were classified in the Preferred category, and 33 percent were classified in the Memorable category (Figure 3).

Mean weight at age ranged from 0.57 kg at age 4 to 2.24 kg at age 11 (Table 1). A significant length-weight regression was

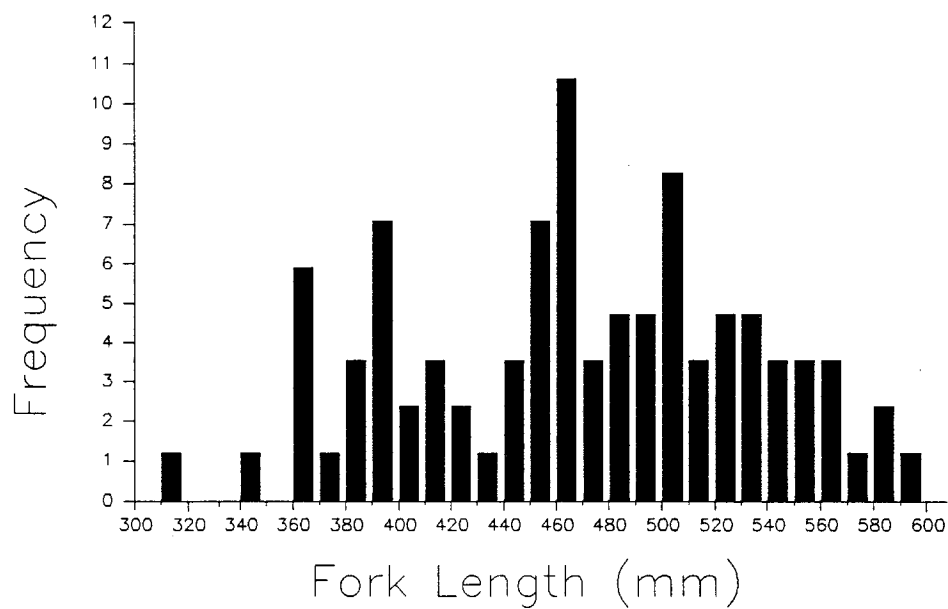


Figure 2.-Length frequency of rainbow trout, Gertrude Creek, Becharof National Wildlife Refuge, Alaska, June and September 1988.

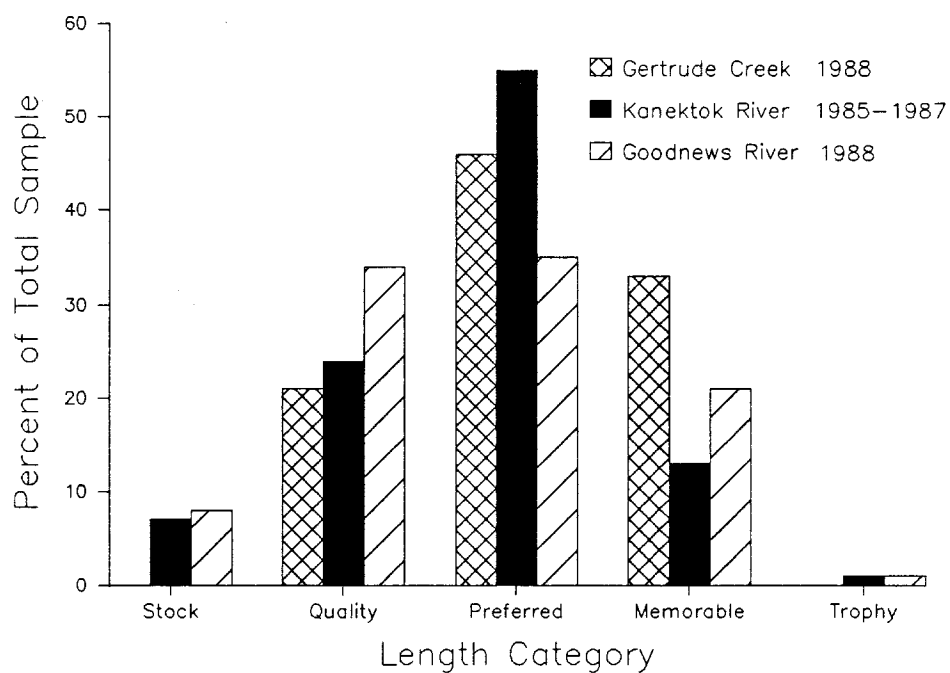


Figure 3.-Rainbow trout Relative Stock Density, Gertrude Creek (N = 85), Kanektok River (N = 1,156) and Goodnews River (N = 38), Alaska. Length categories are: Stock < 300 mm, Quality 300 - 399 mm, Preferred 400 - 499 mm, Memorable 500 - 599 mm, and Trophy > 600 mm.

Table 1.-Mean fork length and weight by age of rainbow trout in Gertrude Creek, Becharof National Wildlife Refuge, 1988.

Age	N	Fork Length (mm)		Weight (kg)	
		Mean	Range	Mean	Range
4	5	352	310 - 386	0.57	0.33 - 0.80
5	14	398	357 - 472	0.76	0.55 - 1.30
6	10	435	377 - 467	0.97	0.55 - 1.40
7	15	470	397 - 536	1.33	0.70 - 2.10
8	13	484	440 - 526	1.41	0.93 - 3.60
9	15	528	482 - 584	1.62	1.23 - 2.65
10	5	569	548 - 588	2.24	1.80 - 3.85
11	1	560		1.73	
Total	77	465	310 - 588	1.26	0.33 - 3.85

estimated for rainbow trout ($r = 0.92$, $N = 86$, $P < 0.001$) (Figure 4). Mean condition factor for each rainbow trout age class was calculated and ranged from 0.98 to 1.27 and appears to be relatively constant (Figure 5).

Sixty-one rainbow trout were aged using scales and ranged from 3-8 years and 77 trout were aged using otolith and ranged from 4-11 years. Comparisons of otolith and scale ages of rainbow trout indicated that scales underestimated the true age of the fish (Figure 6). The mean age determined for the otolith sample was 7 years, and the mean age for the scale sample was 5 years. The difference between otolith and scale ages ranged from 1-4 years. Rainbow trout older than otolith age 7 disagreed with all scale ages, and four of the six oldest fish (ages 10 and 11) had regenerated scales such that ages could not be determined.

Of the rainbow trout that were sexed ($N = 28$), the male:female ratio was 1:1.2. Sexual maturity was reached at 400 mm FL and all mature fish were aged between 6-9 years.

Arctic grayling ($N = 106$) lengths ranged from 265-492 mm FL (Figure 7), and weights ranged from 0.13-1.10 kg. Char ($N = 15$) lengths ranged from 315-546 mm FL, and weights ranged from 0.35-1.60 kg. A significant length-weight regression was estimated for Arctic grayling ($r = 0.90$, $N = 73$, $P < 0.001$) (Figure 8).

Special Use Permits were first issued in 1981. Big game guides dominated permit holders until 1986. The number of sport fishing guide and outfitter permits has increased dramatically since 1986 and presently accounts for 41 percent of the total number of permits (61) (Figure 9). The number of clients and client-use-days have also increased (Figure 10). Salmon account for the majority of harvest followed by char, Arctic grayling, and rainbow trout (Figure 11). The exception was the 1988 reported harvest by sport fishing guides and outfitters where char were the most abundant species harvested. As permittees do not report effort and harvest by individual drainage or distinguish between fish harvested in the Alaska Peninsula and

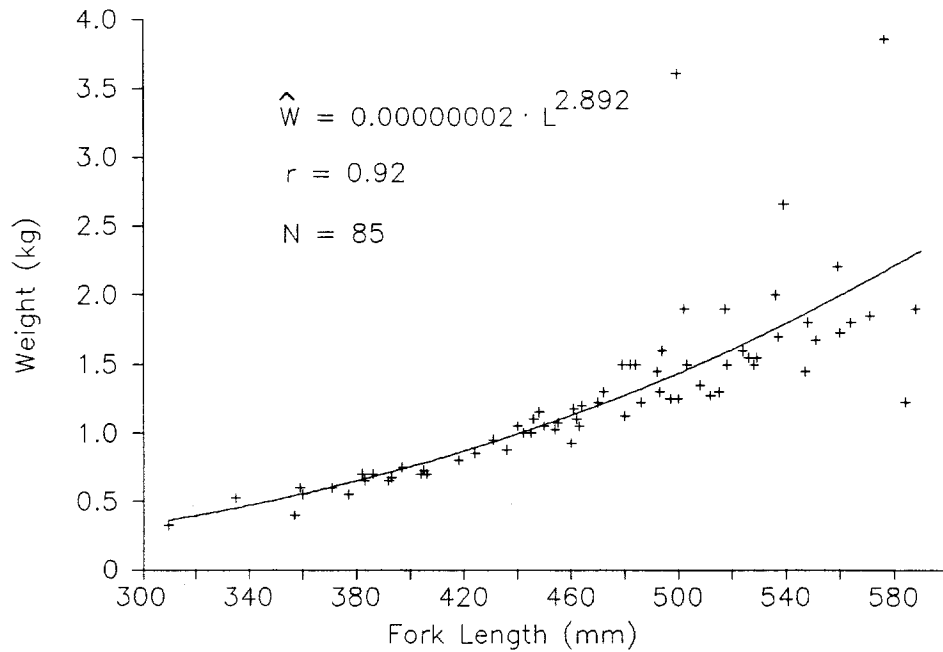


Figure 4.-Length-weight relation for rainbow trout, Gertrude Creek, Becharof National Wildlife Refuge, Alaska, June and September 1988.

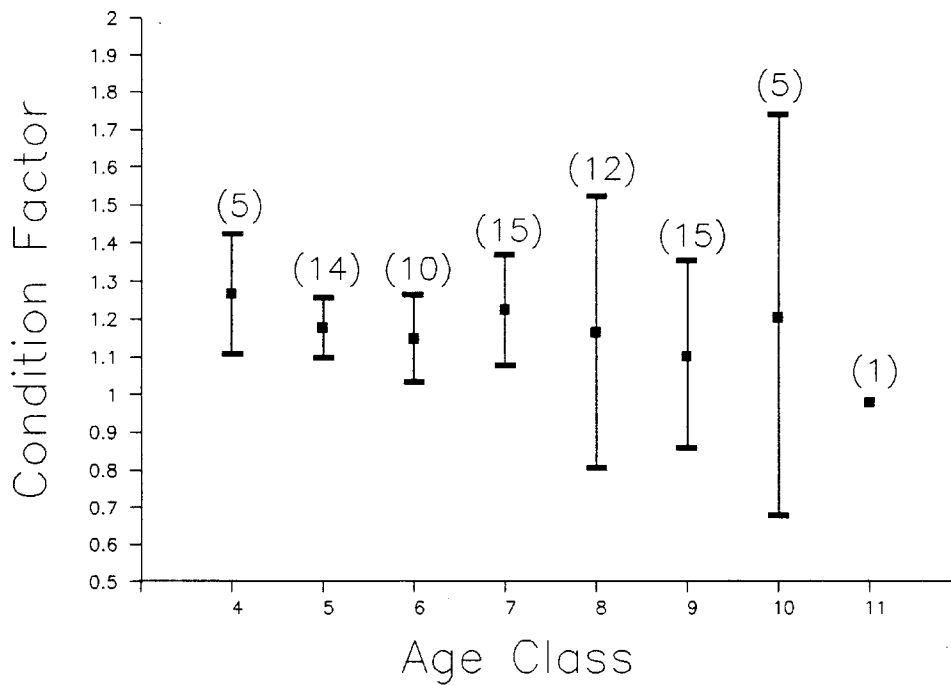


Figure 5.-Mean condition factor and range by age class of rainbow trout in Gertrude Creek, Becharof National Wildlife Refuge, Alaska, June and September 1988. The sample size for each age is in parenthesis.

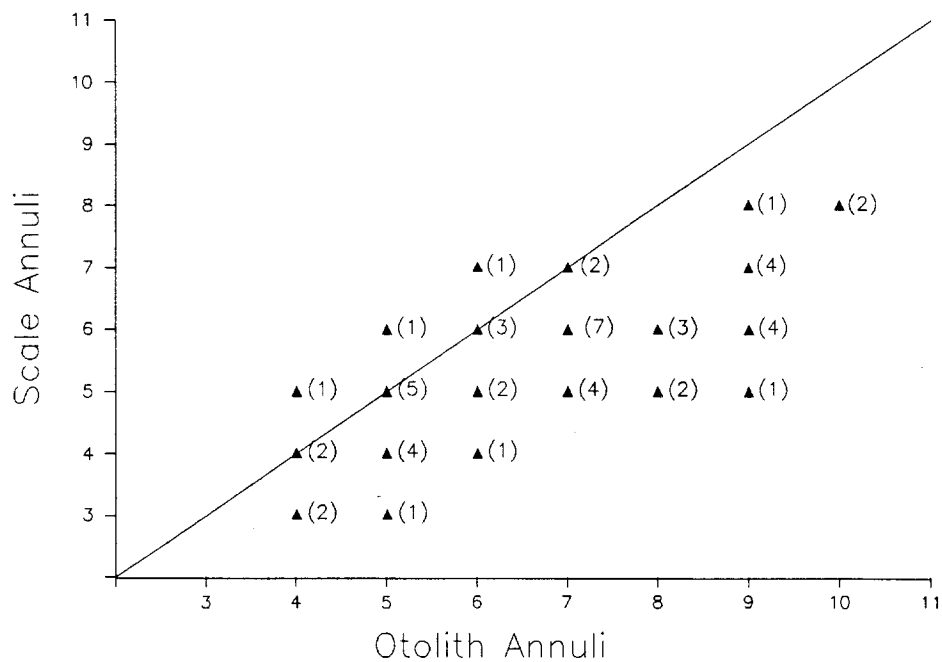


Figure 6.-Relationship between otolith and scale ages of rainbow trout in Gertrude Creek, Becharof National Wildlife Refuge, Alaska, June and September 1988. The line indicates where the scale and otolith age are in agreement.

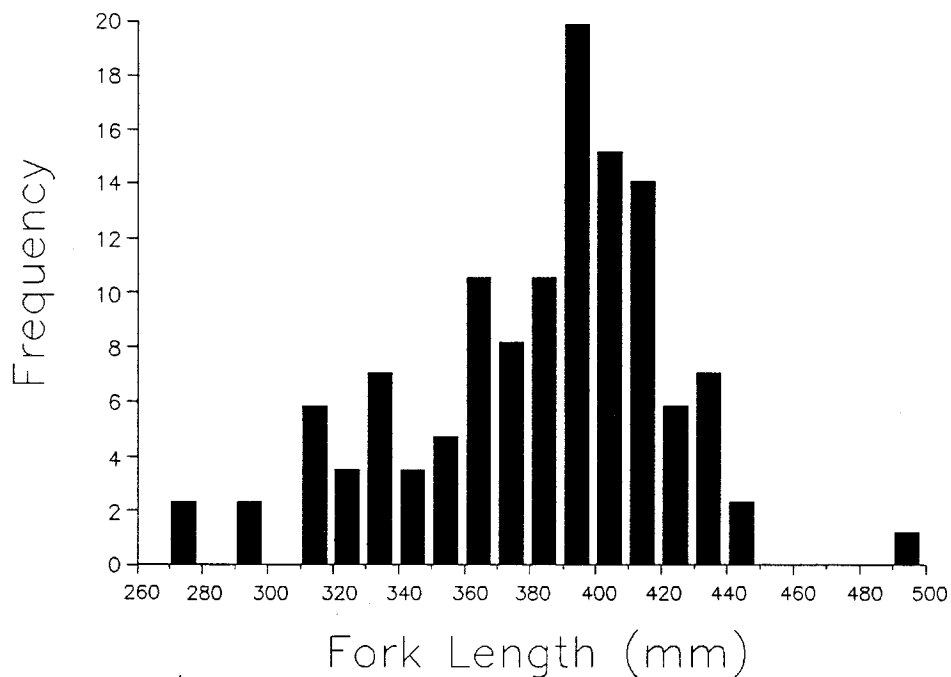


Figure 7.-Length frequency of Arctic grayling, Gertrude Creek, Becharof National Wildlife Refuge, Alaska, June and September 1988.

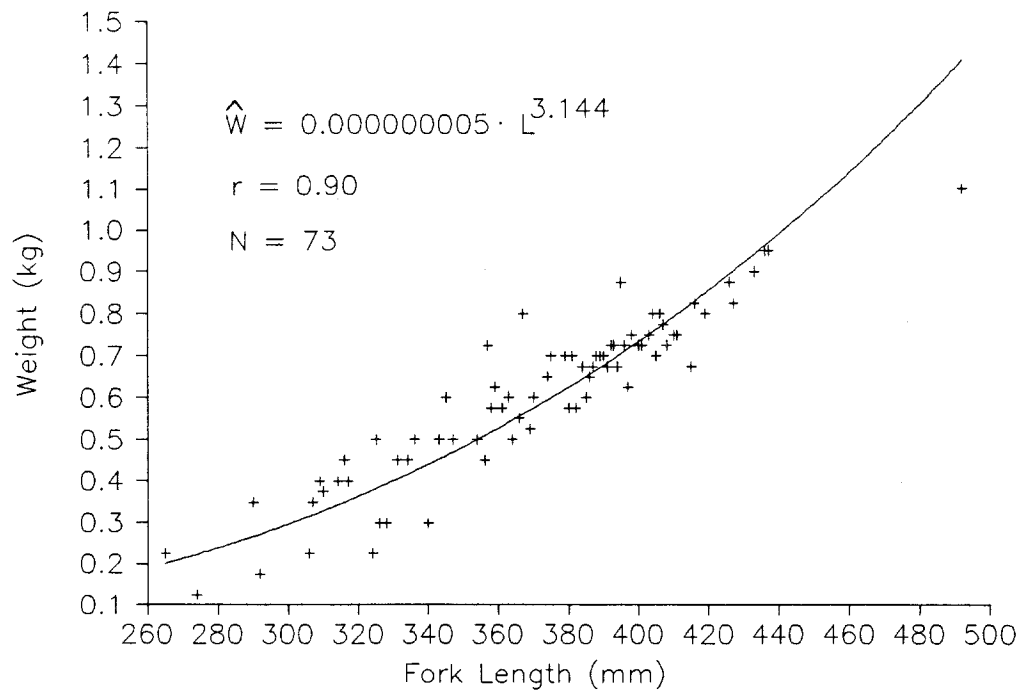


Figure 8.-Length-weight relation for Arctic grayling, Gertrude Creek, Becharof National Wildlife Refuge, Alaska, June and September 1988.

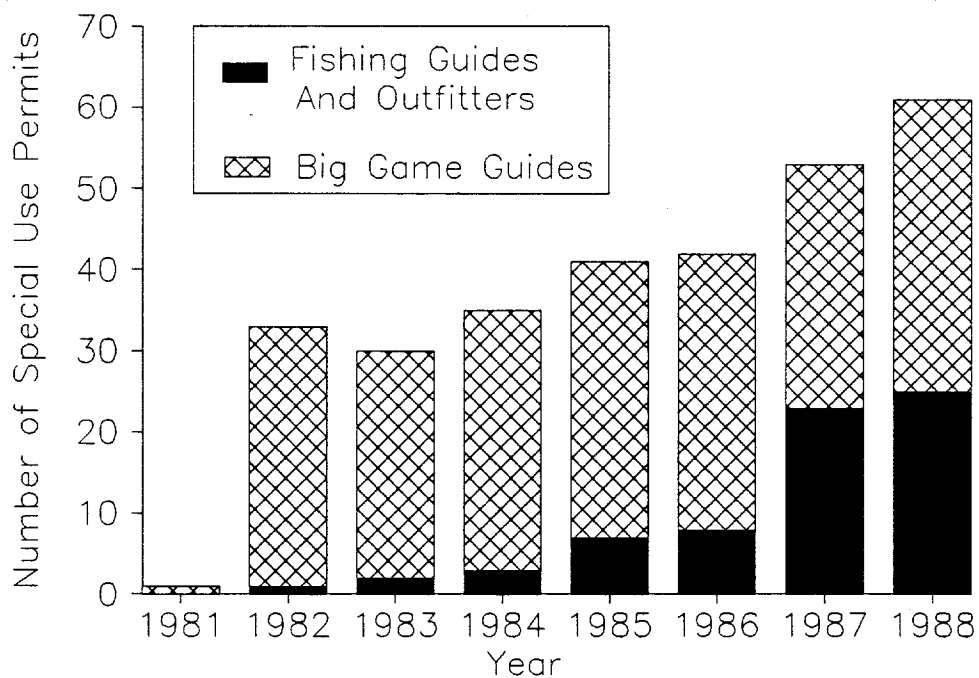


Figure 9.-The number of refuge Special Use Permits issued for Alaska Peninsula and Becharof National Wildlife Refuges, 1981-1988.

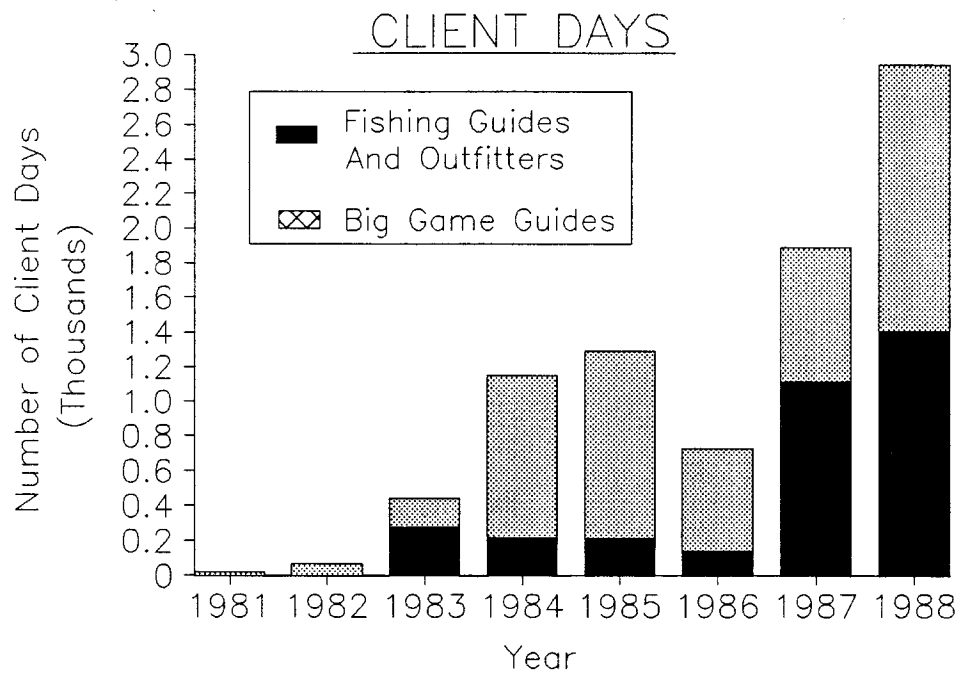
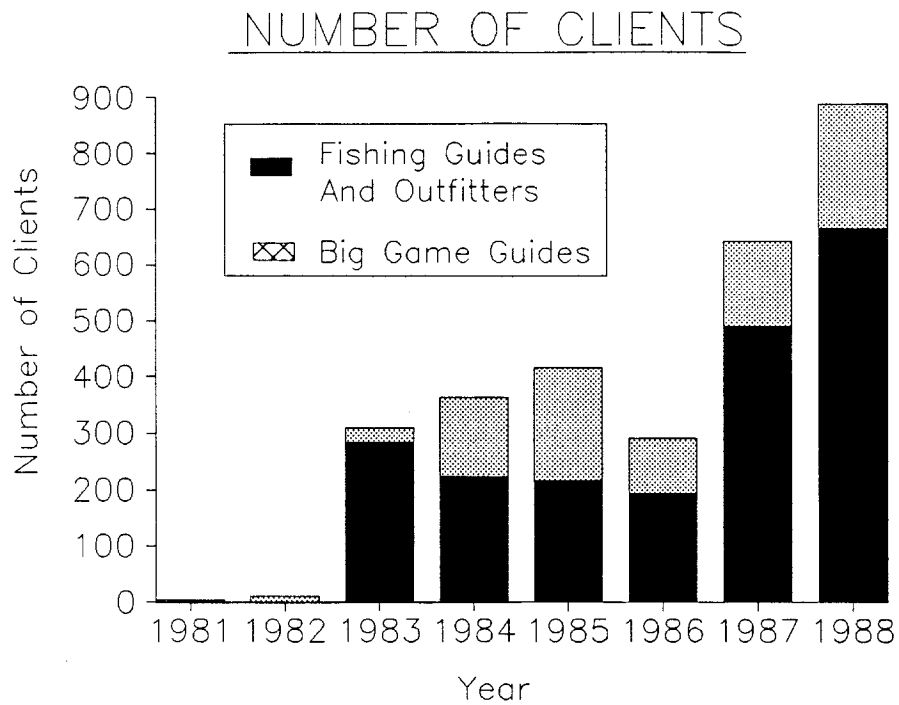
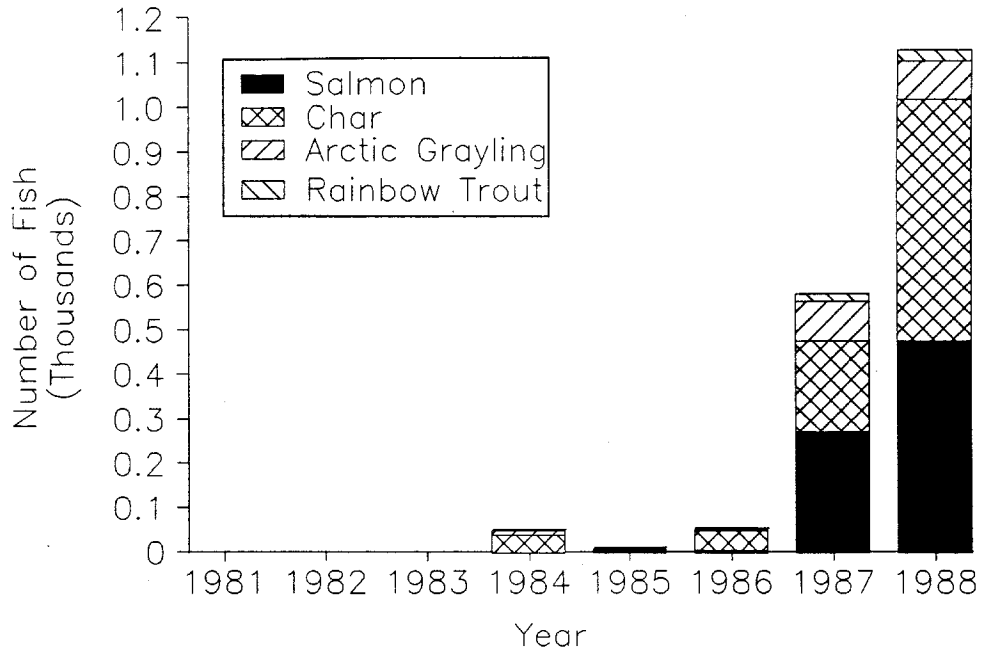


Figure 10.-Reported number of clients and client days for sport fishing guides/outfitters and big game guides, Alaska Peninsula and Becharof National Wildlife Refuges.

SPORT FISHING GUIDES/OUTFITTERS



BIG GAME GUIDES

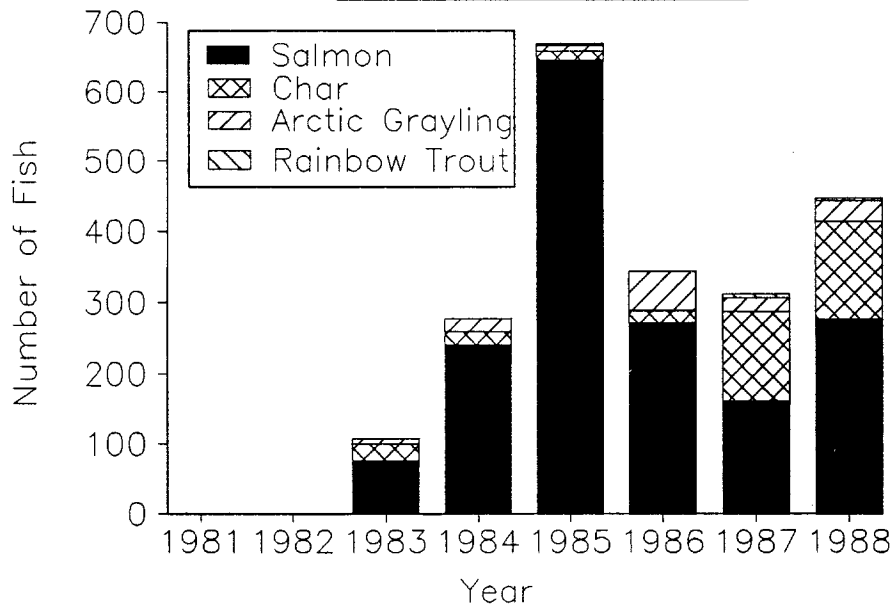


Figure 11.-Reported harvest by sport fishing guides/outfitters and big game guides, Alaska Peninsula and Becharof National Wildlife Refuges.

Becherof National Wildlife Refuges, it is not possible to determine the extent or trend of sport fishing activities on Gertrude Creek.

DISCUSSION

The distribution of rainbow trout found in 1988 was consistent with the findings of others (R. Russell, Alaska Department of Fish and Game, personal communication and D. Mumma, U.S. Fish and Wildlife Service, personal communication). The absence of rainbow trout above Rkm 13 was probably due to poor habitat, as the creek was narrow, swift, and shallow. Gertrude Creek, near the King Salmon River confluence, provided good habitat, but not many fish were captured. It is possible that the more easily accessible lower section of Gertrude Creek has been impacted by sport fishing.

Gertrude Creek rainbow trout were primarily represented in the Preferred (47%) and Memorable (33%) RSD categories. For comparison (Stock category excluded), Kanektok River and Goodnews River rainbow trout on the Togiak National Wildlife Refuge were represented in the Preferred (60% and 38%, respectively), Memorable (14% and 23%, respectively), and Trophy (1% and 1%, respectively) RSD categories. Extensive sampling for rainbow trout provided a large sample size for Kanektok (N = 1,156) and Goodnews Rivers (N = 238). Therefore, the trend for larger rainbow trout at Gertrude Creek, though no trophy fish were caught, may be due to the small sample size (N = 86) or sampling bias.

The 1988 rainbow trout otolith aging indicated a greater range of age classes and a greater maximum age (11) than previously reported for this area. As salmonids may not form a scale annulus during their first year (Lentsch and Griffith 1987) and scales appear to be unreliable for ageing slow growing salmonids, otolith age maybe a more accurate measurement of true age (Barber and McFarlane 1987; Heidinger and Clodfelter 1987).

Examination of younger age classes (ages 0-3) will be necessary to verify otolith ageing techniques.

The maximum size (492 mm) of Gertrude Creek Arctic grayling was similar to that found for Ugashik Narrows, Alaska Peninsula National Wildlife Refuge, Arctic grayling (S. Meyers, Alaska Department of Fish and Game, personal communication).

Special Use Permit report data only provides a measure of overall commercial guide use for Alaska Peninsula and Becharof National Wildlife Refuges. Therefore, it is not possible to determine effort and harvest for individual drainages. Indeed, since only one Special Use Permit is required to guide on both Refuges, it is often not possible to divide the use between either Refuge.

There are no data for the numbers of fish that are caught and released on Gertrude Creek. Catch and release is advocated by many guides. At Ugashik Narrows, Alaska Peninsula Refuge, harvest accounted for a low percentage of the total catch of Arctic char/Dolly Varden (7-8%) and Arctic grayling (5-8%) during 1988. Coho salmon (O. kisutch) (48-53%), sockeye salmon (33-37%), and lake trout (S. malma) had much higher retention rates (S. Meyers, Alaska Department of Fish and Game, personal communication). If the harvest rate for rainbow trout in Gertrude Creek is low, delayed hooking and handling mortality may be the most significant loss of fish. There are no data on hooking mortality for Alaskan rainbow trout. Other investigators have recommended using a 10 percent hooking mortality rate for management decisions (Horton and Wilson-Jacobs 1985).

CONCLUSIONS

The small sample size of Gertrude Creek rainbow trout prevents any definite conclusions about the population structure or the growth rate. From a comparison of age structure and RSD between Gertrude Creek, Kanektok River, and Goodnews River, it appears rainbow trout have not been adversely impacted by sport

fishing. However, we recommend additional field sampling in 1990 to provide more comprehensive information on the Gertrude Creek rainbow trout population. Small side sloughs, tributaries along Gertrude Creek, and the east fork not usually targeted by the sport fishery will be sampled more intensely to capture juvenile rainbow trout. Equipment (i.e., backpack electroshocker, beach seines, minnow traps) will be taken on future trips to increase the capture of juvenile rainbow trout not yet recruited into the sport fishery. Other tributaries to the King Salmon River drainage will be investigated to further document rainbow trout distribution.

Procedures other than using otoliths to assess the population age structure are necessary to insure that older trout are not eliminated from the population. Otoliths provide an accurate estimate of rainbow trout age, but the fish must be sacrificed. Depending on the number of fish sacrificed, the sampling may have a greater impact on the population than sport fishing. Scales underestimated the true age of the rainbow trout. The use of the RSD as an index to monitor the percentage of fish in each category may provide one solution to monitor changes in population structure. If changes in the RSD are noted over time, then otoliths could be collected to confirm the changes in the age structure of the population.

Special Use Permit reporting requirements should be revised to include data on effort, catch, and harvest by individual drainage. An alternative would be to develop a daily log book for permittees, whereby data would be entered on preprinted forms. Log books would be turned in each year and these data compiled by refuge personnel. This latter option would require an effort to educate guides and gain their cooperation.

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